

# **STRUCTURE FOR EXPANDING THERMAL CONDUCTING PERFORMANCE OF HEAT SINK**

## **BACKGROUND OF THE INVENTION**

The present invention relates in general to a structure for expanding  
5 thermal conducting performance of a heat sink, and more particularly, to a  
heat sink with improved thermal conductivity.

The conventional heat sink includes a bottom plate and a top plate  
covered with each other to form a planar enclosure. A wick structure is  
installed inside of the planar enclosure. A working fluid the introduced into  
10 the planar enclosure. The planar structure is exhausted and sealed to form a  
heat sink.

As the conventional heat sink is in the form of a planar structure which  
delivers heat from the bottom to the top thereof, fins or tubular heat pipe are  
typically used to aid in heat dissipation. However, though the fins can be  
15 integrally formed on the heat sink, the heat dissipation effect of the fins is  
restricted by the material characteristics thereof. The heat pipe is normally  
connected to the heat sink by solder, which often obstructs the heat  
conductance of the heat sink.

To resolve the problems caused by the conventional heat sink as  
20 described above, the Applicant, with many years of experience in this field,  
has developed an improved structure for expanding thermal conducting  
performance of- the heat sink as described as follows.

## **SUMMARY OF THE INVENTION**

The present invention provides a structure for expanding thermal  
25 conducting performance of a heat sink, such that the applicability and value  
of the heat sink having improved thermal conductivity are enhanced.

The structure provided by the present invention comprises a bottom

plate, a top plate, a hollow filling tube, a wick structure and a hollow thermal expansion conductor. The top and bottom plates are covered with each other to form a planar shell, in which an upper receiving chamber and a lower receiving chamber are formed. The hollow filling tube is filled with a working fluid. The thermal expansion conductor is embedded in the planar shell and in fluid communication with the upper and lower receiving chambers. Therefore, the thermal expansion conductor serves as an extension of the planar shell for thermal conduction.

These and other objectives of the present invention will become obvious to those of ordinary skill in the art after reading the following detailed description of preferred embodiments.

It is to be understood that both the foregoing general description and the following detailed description are exemplary, and are intended to provide further explanation of the invention as claimed.

## BRIEF DESCRIPTION OF ACCOMPANIED DRAWINGS

The above objects and advantages of the present invention will be become more apparent by describing in detail exemplary embodiments thereof with reference to the attached drawings in which:

Figure 1 is an exploded view of a heat sink;

Figure 2 is an exploded view of a structure for expanding the thermal conducting performance of the heat sink in a first embodiment of the present invention;

Figure 3 is a perspective view of the structure;

Figure 4 shows the structure that includes a plurality of fins;

Figure 5 shows a cross-sectional view of Figure 4;

Figure 6 shows an enlarged view of region A in Figure 5;

Figure 7 shows a perspective view of a second embodiment; and

Figure 8 shows a perspective view of a third embodiment.

## DETAILED DESCRIPTION OF EMBODIMENT

Reference will now be made in detail to the preferred embodiments of the present invention, examples of which are illustrated in the accompanying drawings. Wherever possible, the same reference numbers are used in the  
5 drawings and the description to refer to the same or like parts.

As shown in Figures 1 to 3, an exploded of a heat sink body, an exploded view and a perspective view of a structure for expanding thermal conducting performance of the heat sink are illustrated. The structure includes a thermal expansion conductor 2 embedded in the heat sink 1. The  
10 thermal expansion conductor 2 has good thermal conducting efficiency. The thermal expansion conductor 2 is hollow and is in fluid communication with an internal space of the heat sink 1. Therefore, the thermal expansion conductor 2 serves as an extension of the heat sink 1 for thermal conduction. By the thermal expansion conductor 2, heat is absorbed and dissipated away  
15 from the heat sink, or conducted and delivered to a specific position for dissipation. Therefore, the thermal conducting performance of the heat sink 1 is expanded.

As shown in Figure 1, the heat sink 1 includes a bottom plate 10, a top plate 11, a hollow filling tube 12 and a wick structure 13. In this  
20 embodiment, the bottom plate 10 includes a top surface and a sidewall protruding from the top surface to form a lower receiving chamber 100, and the top plate 11 includes a bottom surface and a sidewall protruding from the bottom surface to form a lower receiving chamber. The sidewalls of the bottom and top plates 10 and 11 each comprises a flange 101 and 111  
25 extending along the edges of the sidewalls, respectively. The flanges 101 and 111 are further processed to form semi-circular slots 102 and 112, respectively. The bottom and top plates 10 and 11 are then covered with each other with the flanges 101 and 111 overlapped with each other, and the

semi-circular slots 102 and 112 aligned over each other. Thereby, the upper receiving chamber 110 is aligned over the lower receiving chamber 100, and a closed planar shell 14 is formed.

As shown in Figure 1, the heat sink 1 further comprises a hollow filling tube 12 with a proximal open end inserted into the planar shell 14 through the semi-circular slots 102 and 112 and a distal open end 120 extending outside of the sidewall of the planar shell 14. Therefore, the hollow filling tube 12 is in fluid communication with the lower and upper receiving chambers 100 and 110. Thereby, a working fluid can be filled into the planar shell 14, and gas inside the planar shell 14 can be exhausted through the filling tube 12. After the filling and exhausting processes, the distal open end 120 can be capped as a closed end 121 as shown in Figure 4. In addition, the wick structure may be attached between the top and bottom plates 11 and 10. A plurality of supporting columns 113 extending from the bottom surface of the top plate 11 to the top surface of the bottom plate 10 may be formed by stamping process to enhance the strength of the planar shell 14.

As shown in Figures 2 and 3, the heat sink 1 is embedded with at least one thermal expansion conductor 2, which includes a tubular heat pipe 20 in this embodiment. One end of the tubular heat pipe 20 is inserted between the top plate 11 and the bottom plate 10, such that the tubular heat pipe 20 is in communication with the top receiving chamber 110 and the bottom receiving chamber 10 as shown in Figures 5 and 6. The other end of the tubular heat pipe 20 extends outside of the planar shell 14. The other end of the tubular heat pipe 20 is bent or curved in accordance with the heat conduction direction. The tubular heat pipe 20 includes a wick structure 200 (as shown in Figure 6). It will be appreciated that the method of inserting the tubular heat pipe 20 between the top and bottom plates 11 and 10 can be the same as those for the filling tube 12.

As shown in Figures 4 and 5, when the heat sink 1 is subject to heat,

the work fluid is transited from a liquid phase to a gas phase to conduct heat to the other end via the tubular heat pipe 20. Meanwhile, if fins 201 are mounted at the other side of the tubular heat pipe 20, the heat dissipation is further aided. The gaseous work fluid will be cooled down and a phase transition from gas to liquid will occur. The liquid work fluid can then re-flow back in the heat sink 1 via the wick structure 200. Thereby, heat circulation is re-iterated.

As shown in Figures 7 and 8, the thermal expansion conductor 2 can also be in the form of a heat plate 21 (as shown in Figure 7) or a columnar heat pipe 22 with a larger gauge (as shown in Figure 8). The heat plate 21 or the columnar heat pipe 22 can be directly embedded in the top plate 11 or the bottom plate 10 to extend perpendicularly to the planar shell 14.

Therefore, by the structure provided by the present invention, the heat absorbed by the heat sink 1 can be dissipated away from the heat sink 1 via the thermal conduction of the thermal expansion conductor 2. As the thermal expansion conductor is partially embedded in the heat sink 1 and partially extending outside of the heat sink, the fabrication material of the thermal expansion conductor is not restricted.

While the present invention has been particularly shown and described with reference to preferred embodiments thereof, it will be understood by those of ordinary skill in the art the various changes in form and details may be made therein without departing from the spirit and scope of the present invention as defined by the appended claims.